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Research on the Impact of China's Rare Earth Export Control Measures on Domestic Enterprises and the International Market

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Abstract

As a core strategic resource in the global high-tech field, rare earths, with their unique physical and chemical properties, play a crucial role in high-end manufacturing, new energy, national defense, and military industries. As the world's largest producer and exporter of rare-earth permanent-magnet materials, China has built a competitive advantage covering the entire industry chain. To maintain the sustainable use of resources and industrial security, the Chinese government has implemented a series of export control measures, which have a profound impact on the transformation and upgrading of domestic enterprises and the pattern of the international market.

Keywords

Rare Earths; Export Control Measures; Export Trade; International Market; Impact.

1. Analysis of the Current Situation of Rare Earth Export Trade

Rare earths are a general term for 17 metallic elements in the periodic table, including the lanthanide series, scandium, and yttrium [1]. They have unique physical and chemical properties and play an important role in the fields of magnetism, optics, and electricity. They have become core materials in high-end manufacturing industries such as new-energy vehicles, electronic information, and aerospace. Permanent-magnet materials prepared from elements such as neodymium and samarium have strong magnetism and high coercive force. They are widely used in products such as high-efficiency motors and engines to achieve the conversion of mechanical energy and electrical energy, and are key basic materials in new-generation automobiles, energy-saving home appliances, and renewable energy fields [2].

As the world's largest production and export base for rare-earth permanent-magnet materials, China's annual output of rare-earth permanent-magnet materials exceeds 90% of the global total. The rare-earth industry is one of the few industries in China with global competitiveness [3]. Before the reform and opening-up, China exported a small amount of rare-earth raw materials without strategic planning and management. With the urgent need for foreign exchange in economic construction, the export of rare earths gradually increased. At the same time, affected by the export tax rebate policy, the export volume of rare earths increased from 4,500 tons in 1985 to 16,000 tons in 1994. It was not until 2006 that, through measures such as canceling the export tax rebate policy for rare-earth products and implementing tariff collection, the management of rare-earth raw material exports was strengthened, and the export of rare-earth raw materials was reduced. According to the data of the General Administration of Customs, in 2024, the cumulative export of rare earths in China was 55,431.1 tons, a year-on-year increase of 6.0%. However, affected by fluctuations in international market prices and the optimization and adjustment of the product structure, the annual export value was only $489 million, a year-on-year decrease of 36%, and the average export price dropped to $0.88 million/ton, a decrease of $0.58 million/ton compared with 2023. In the same year, the export volume of China's rare-earth permanent-magnet materials was about 58,100 tons,

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accounting for about 24% of the annual output. Japan and the United States were the main export destinations. In 2024, 83.7% of the total rare-earth imports of the United States came from China, and its dependence on heavy rare earths was as high as 97%; while Japan's proportion of rare-earth imports from China dropped to 58%.

2. Content and Evolution of China's Rare Earth Export Control Measures

2.1. Encouragement Stage during the Reform and Opening-up Period

In the mid-1970s, China had the ability to produce high-quality rare-earth minerals. In order to stimulate industrial development and accumulate foreign exchange reserves, the country began to expand the export of rare-earth products to obtain foreign exchange income. The "Interim Measures on the Export License System" issued in 1980 included 129 products such as rare earths in the scope of export license management. The export tax rebate policy implemented since 1985 set the tax rebate rate for rare-earth ores at 13% and that for rare-earth metals at 17%, which further stimulated the production of upstream enterprises and significantly increased the output of rare-earth ores. At the same time, Japan transferred factories and technology to China, further promoting the development of domestic enterprises and the rapid development of the rare-earth industry. Affected by the export tax rebate policy, the output of rare-earth ores increased by an average of 22% annually from 1991 to 1998, achieving short-term prosperity.

2.2. Restriction Stage in the Early 21st Century

Due to the rapid development of rare-earth trade, there were two voices in China: "further developing the economy" and "paying attention to the sustainability of environmental resources". Therefore, China began to seek ways to transform the trade growth mode and issued a series of control measures. In 1999, the government implemented the export quota management system. In the following years, China continuously reduced the export quota to achieve the export structure control of the rare-earth industry. In 2008, the reduction ratio was as high as 21%, making China's rare-earth quota volume lower than the international market demand for the first time. The export tax rebate policy for rare earths caused a series of problems, such as overcapacity of rare-earth production and a decline in resource reserves. Therefore, in 2005, the export tax rebate system for rare-earth metal ores and rare-earth compounds was completely abolished, and export tariffs were levied from 2006, which transformed China's rare-earth export market towards standardization and scientific management. However, affected by the WTO rare-earth case in 2012 and the international situation, China officially abolished the export quota system and the tariff system in 2014 and replaced them with the export license system.

2.3. Re-encouragement Stage from 2014 to 2022

After the WTO rare-earth case, China actively and openly participated in the global rare-earth industry competition and issued a series of systems to rebuild the industrial order and promote market-oriented reforms. For example, the "Rare Earth Industry Standard Conditions" and the "Rare Earth Industry Development Plan (2016-2020)" announced in 2016, the "Environmental Protection Tax Law of the People's Republic of China" announced in 2018, and since 2019, rare-earth export licenses have no longer specified the port of declaration. These measures have played a huge role in cracking down on illegal enterprise production, promoting cost-reduction and efficiency-improvement of enterprises, promoting industrial development, and improving export trade.

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2.4. Re-restriction Stage since 2023

With the progress of high-tech, rare-earth resources have become key strategic resources. Western countries such as the United States are highly dependent on rare-earth imports from China. In 2023, Western countries, led by the United States, carried out sanctions against China in political, economic, and other fields to suppress the development of China's high-tech fields. In response, China implemented export control measures on related items such as gallium and germanium. In December of the same year, China once again announced a ban on the export of rare-earth separation and extraction technology. In response to the actions of Western countries that disrupted the international market order, China effectively responded by taking measures such as export quotas, restricting foreign investment, and banning the export of rare-earth raw materials, resulting in international trade frictions.

3. Impact of China's Rare Earth Export Control Measures on Domestic Enterprises

3.1. Regulating Enterprise Trade Costs

The implementation of export control measures such as tariffs, quotas, and license systems will significantly increase the trade costs of downstream rare-earth export enterprises, including production, resource inter-generational, environmental, and transaction costs, thus affecting the production and trade arrangements of enterprises [4]. Production costs include material procurement, labor remuneration, and various expenses generated in the manufacturing process; resource inter-generational costs are mainly reflected in the costs of mining non-renewable resources and rationally using renewable resources; environmental costs are reflected in pollution treatment, energy conservation and emission reduction, and ecological compensation costs; transaction costs are reflected in tariffs, transaction negotiation, transportation, etc.

Export control measures increase raw material costs in the short term, prompting enterprises to adjust their production and trade arrangements, resulting in a short-term reduction in the export volume of downstream industries. In addition, the competition pattern of the rare-earth industry trade is also affected. The increase in trade costs puts downstream enterprises under greater market pressure and may even force them to withdraw from the market. On the other hand, market pressure will also promote enterprise progress, and promote industrial optimization, integration, and upgrading. Appropriate trade costs are conducive to standardizing the export behavior of enterprises, optimizing the allocation and supply of rare-earth resources, protecting the sustainable development of the rare-earth industry, and enhancing China's influence and voice in the global rare-earth field [5].

3.2. Promoting Industrial Chain Upgrading

China's rare-earth industry has established a complete and mature full-industry-chain system, covering core links such as rare-earth ore exploration and mining, smelting and separation, and deep processing, and extending to the entire field of downstream applications. In the upstream of the industry chain, China is still the world's largest rare-earth producer; in the middle of the industry chain, China has mastered the world-leading rare-earth smelting and separation technology and controls the global market for high-purity single rare earths, accounting for 90% of the global total rare-earth smelting output. In the downstream of the industry chain, however, there is a large gap between China's production capacity of high-value-added products such as high-performance neodymium-iron-boron magnetic materials and that of Japan.

By implementing rare-earth export control measures, reducing the export of upstream rare-earth raw materials and mid-stream high-purity rare-earth elements, enterprises are forced to shift their focus to downstream high-value-added products. Taking advantage of the upstream

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and mid-stream advantages in the rare-earth supply chain, enterprises can further develop downstream rare-earth material deep-processing technology, thus realizing the adjustment and upgrading of the industrial chain structure. At the same time, the upstream and downstream of the industrial chain can further strengthen technological integration, cooperation, and communication, realizing resource sharing, risk sharing, and complementary advantages, so as to more easily cope with changes and impacts in the international market and form a complete and competitive industrial chain. The adjustment and optimization of the industrial structure also eliminate some backward production capacities with low technical levels, low production efficiency, and unreasonable resource utilization, and promote the industry to move towards green and high-end development.

3.3. Promoting Enterprises to Carry out Technological Innovation

Although China has a complete industrial chain in the rare-earth field, it still lacks core competitiveness compared with foreign industries. Facing the supply uncertainty caused by various export control measures, domestic enterprises need to increase investment in technological innovation, develop new production processes, improve the utilization efficiency of raw materials, or develop substitute materials or products to reduce their dependence on rare-earth raw materials [6], and effectively solve the long-standing structural contradiction of "insufficient high-end production capacity and excessive mid-and low-end production capacity" faced by Chinese enterprises. Taking neodymium-iron-boron magnetic materials as an example, although China accounts for more than 60% of the global production capacity, the technology of high-grade (N52 and above) products used in new-energy vehicles, high-end robots and other fields is still dominated by Japanese companies such as TDK and German company VAC. Export control measures encourage enterprises to increase investment in the research and development of key technologies such as neodymium-iron-boron grain-boundary diffusion technology and nanocomposite permanent-magnet preparation, which can not only meet the needs of domestic high-end manufacturing, but also participate in international market competition with technological advantages and break the technological monopoly of developed countries.

4. Impact of China's Rare Earth Export Control Measures on the International Market

4.1. Promoting Enterprises to Carry out Technological Innovation

Rare-earth materials have extremely high strategic value. Therefore, countries around the world attach great importance to the supply and trade of rare-earth resources. China's export control measures will cut off the low-cost and stable supply of rare-earth raw materials from Chinese enterprises, ultimately leading to trade frictions in the raw material field. Western countries such as the United States use political means such as the WTO to sanction downstream rare-earth industries such as permanent-magnet materials, include enterprises in terminal application fields such as chips on the entity list, and set up technical trade barriers and other economic means to continuously pressure China [7].

After export control measures trigger trade frictions, countries will strengthen their attention and review of rare-earth trade. This directly restricts China's rare-earth raw material supply and trade, and also hinders foreign technical exchanges. Market prices fluctuate greatly, and enterprises face operational risks such as restricted supply and loss of market share. This not only limits the development of downstream enterprises but also leads to the loss of development space in the international market. From another perspective, the trade barriers resulting from trade frictions in the raw material field can, conversely, prompt enterprises to

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carry out technological innovation and product upgrading and shift to the export of high-value-added products.

4.2. Impact on Western Countries and the International Market Linkage Effect

Rare earths are regarded as critical mineral resources by Western countries such as the United States. They are of great significance to national defense construction and economic development, directly affecting the development and maintenance capabilities of emerging technologies, thus having an impact on employment and economic prosperity, and triggering a chain reaction in the international market through the global industrial chain transmission mechanism.

In the economic field, the downstream rare-earth industries of Western countries are highly dependent on China's raw material imports, and a division of labor model of "China's resource supply-Western technology transformation-global market output" has been established. The downstream rare-earth industry chains of Western countries have the characteristics of high industrial added value. China's implementation of export control measures may directly lead to the risk of raw material shortages in fields such as electronic medical equipment manufacturing, new-energy vehicles, and aerospace in Western countries. According to data from the US Geological Survey, in 2023, more than 90% of the rare-earth oxide processing in the United States relied on China. Every 10,000-ton interruption of rare-earth supply will lead to a production value gap of approximately $42 billion in its high-end manufacturing industry.

In the political field, rare-earth elements are the core support for Western countries such as the United States to achieve their carbon neutrality goals. Rare-earth elements are widely used in products such as wind turbines, electric vehicles, and catalytic converters. The US Department of Energy listed rare-earth elements as key materials for clean energy technologies as early as 2011. According to the provisions of the US "Inflation Reduction Act", after 2024, at least 40% of the rare-earth materials used in electric vehicle batteries need to come from North America. Previously, due to trade with China, the construction of its domestic supply chain lagged behind. After the implementation of export controls, the domestic rare-earth processing capacity in the United States can only meet 12% of the demand for new-energy vehicles. A more far-reaching impact is the reconstruction of international market rules. The European Union requires member states to establish a rare-earth reserve mechanism and promotes the WTO to revise the "Agreement on Technical Barriers to Trade", trying to incorporate "supply chain resilience" into international trade rules, which will further intensify the rules game in the international market.

In the field of national defense security, rare-earth elements are used to manufacture radar systems, sonar systems, and other systems, as well as precision-guided weapons, fighter jets, launch vehicles, nuclear-powered submarines, and other equipment. At present, China is the main supplier of rare-earth elements required for the terminal manufacturing of missiles and ammunition in the United States. If China completely cuts off the supply of terbium and dysprosium, the production line of its "Standard-6" missiles will be shut down within 3 months, and the production capacity of the radar system of the F-35 fighter jet will decrease by 40%. This situation not only directly affects the national defense security of the United States but also changes the international arms market. Countries such as Saudi Arabia and Turkey, which rely on US-made weapons, begin to seek diversified supplies.

5. Conclusion

As an indispensable strategic resource in the high-tech field, rare-earth elements play a key role in promoting scientific and technological progress and are the focus of attention in the raw-material field of countries around the world. With rich rare-earth reserves and production,

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China plays a pivotal role in the global rare-earth supply chain. To ensure the sustainable development of rare-earth resources and promote the green and high-end development of the industry, the Chinese government, based on considerations of national security and global governance, has introduced a series of export control policies. These measures, while standardizing resource allocation and enhancing industrial competitiveness, also have multi-dimensional impacts on the transformation and upgrading of domestic enterprises and the supply-demand pattern of the international market.

Facing the pressure of complex global industrial chain reconstruction, relevant departments should improve the control policy system in a dynamic and precise manner, timely adjust the implementation categories, intensity, and objects of export control measures, formulate scientific and reasonable policy measures, and achieve the goals of trade structure upgrading, economic development promotion, and national interest protection. More importantly, it is necessary to continuously consolidate China's core position in the global rare-earth supply market to ensure that the rare-earth tool can be effectively used to maintain the security of the industrial chain and strategic interests in the complex international situation.

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